

PREVALENCE OF *HELICOBACTER PYLORI* INFECTION AND
ASSOCIATED RISK FACTORS AMONG PATIENTS WITH GASTRITIS:
A CROSS-SECTIONAL STUDY

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Abstract

Background: *Helicobacter pylori* infection is a major cause of chronic gastritis and remains an important public health concern, particularly in populations where inadequate sanitation, unsafe drinking water, and poor hygiene practices may facilitate transmission. Determining the prevalence and associated risk factors of *H. pylori* infection is important for developing effective preventive and clinical strategies.

Objectives: This study aimed to determine the prevalence of *Helicobacter pylori* infection and identify socio-demographic, environmental, hygiene-related, lifestyle, and medical factors associated with infection among patients presenting with gastritis.

Methods: A hospital-based cross-sectional study was conducted over a period of three months among 220 adult patients presenting with gastritis. Data were collected using a structured questionnaire covering socio-demographic characteristics, drinking-water sources, food consumption patterns, hygiene practices, household conditions, environmental sanitation, lifestyle behaviours, and medical history. *Helicobacter pylori* infection was determined using a rapid antibody test. Data were analysed using SPSS version 21.0. Descriptive statistics were used to summarise the characteristics of the participants, while associations between *H. pylori* infection and potential risk factors were assessed using the chi-square test. A *p*-value of <0.05 was considered statistically significant.

Results: Of the 220 patients included in the study, 138 (62.7%) tested positive for *Helicobacter pylori* infection, while 82 (37.3%) were negative. The prevalence of infection was higher among participants exposed to unsafe or untreated drinking water, frequent consumption of street or unhygienically prepared food, inadequate hand-washing practices, overcrowded household conditions, and poor environmental sanitation. Participants using untreated tap water and those living in larger households demonstrated higher

proportions of *H. pylori* positivity compared with their respective counterparts. Significant associations were observed between *H. pylori* infection and key environmental and hygiene-related factors, including drinking-water quality, food hygiene, hand-washing practices, household crowding, and environmental sanitation ($p < 0.05$). The findings demonstrate a considerable burden of *H. pylori* infection among patients presenting with gastritis and highlight the contribution of potentially preventable environmental and behavioural risk factors.

Conclusion: The study identified a high prevalence of *Helicobacter pylori* infection among patients with gastritis, with 62.7% of the study population testing positive. The observed associations with unsafe drinking water, poor food hygiene, inadequate hand hygiene, household overcrowding, and poor environmental sanitation suggest that improvements in water safety, food hygiene, personal hygiene, and sanitary conditions may contribute to reducing *H. pylori* transmission. Strengthening community awareness, preventive practices, and appropriate diagnostic and management strategies may therefore be important for reducing the burden of *H. pylori*-associated gastritis in the studied population.

1. INTRODUCTION

Gastritis is an inflammatory condition of the gastric mucosa that may arise from infectious, autoimmune, chemical, and other pathological processes. Among the various causes, *Helicobacter pylori* (*H. pylori*) infection is recognised as a major cause of chronic gastritis and may contribute to progressive gastric mucosal damage, including atrophy and intestinal metaplasia. Persistent infection has also been associated with peptic ulcer disease and an increased risk of gastric malignancy, highlighting the clinical importance of early identification and appropriate management of infected individuals (Rugge et al., 2020; Malfertheiner et al., 2023).

H. pylori is a spiral-shaped, Gram-negative bacterium that is adapted to survive within the acidic gastric environment. Its urease activity facilitates survival in gastric acid, while virulence factors including cytotoxin-associated gene A (*cagA*) and vacuolating cytotoxin gene A (*vacA*) contribute to epithelial injury and persistent inflammation. Chronic infection can produce characteristic inflammatory changes in the gastric mucosa and, in susceptible individuals, may progress through a sequence involving atrophy, intestinal metaplasia and dysplasia (Nejati et al., 2018; Malfertheiner et al., 2023).

The distribution of *H. pylori* infection varies considerably according to socioeconomic conditions, sanitation, household characteristics and environmental exposures. Infection is frequently acquired during childhood and may persist for many years. Crowded living conditions, inadequate sanitation, poor access to clean water, low socioeconomic status and household exposure have been identified as important factors associated with transmission, particularly in low- and middle-income settings. Behavioural and lifestyle factors, including smoking and dietary and hygiene practices, may also influence susceptibility and persistence of infection (Mezmale et al., 2020; Agbor et al., 2018; Kotilea et al., 2019; Lin et al., 2023).

The burden of *H. pylori* infection remains substantial despite declining prevalence in some populations. Global prevalence has been estimated to be approximately 43% during 2011–2022, although considerable geographical and socioeconomic variation persists (Li et al., 2023). Evidence from Pakistan also indicates that *H. pylori* remains prevalent among individuals presenting with gastritis and other gastroduodenal conditions. Studies conducted in different Pakistani populations have reported associations between infection and factors such as poor

hygiene, contaminated water, overcrowding, tobacco use and unfavourable socioeconomic conditions (Ullah et al., 2023; Aziz et al., 2023; Hamza et al., 2023). However, prevalence and associated risk factors may differ between populations because of variations in environmental, demographic and behavioural characteristics.

Understanding the prevalence of *H. pylori* infection among patients with gastritis and identifying factors associated with infection are therefore important for improving early detection and informing preventive strategies. Local evidence is particularly relevant in populations where environmental and socioeconomic conditions may differ from those reported in other regions. Accordingly, the present study was conducted to determine the prevalence of *H. pylori* infection and to assess its associated risk factors among patients with gastritis.

Aim and Objectives

The aim of this cross-sectional study was to determine the prevalence of *Helicobacter pylori* infection among patients with gastritis and to identify factors associated with infection. The study assessed variations in *H. pylori* prevalence according to demographic characteristics, including age and sex, and examined selected lifestyle, socioeconomic, hygiene, and environmental factors, including smoking, dietary habits, water source, and sanitation practices. By identifying the prevalence and factors associated with *H. pylori* infection, the study sought to provide evidence that may support improved prevention, early detection, and management of *H. pylori*-associated gastritis.

2. CRITICAL ANALYSIS OF PREVIOUS RESEARCH

Globally, available evidence demonstrates substantial variation in the prevalence of *Helicobacter pylori* infection across populations, reflecting differences in socioeconomic conditions, sanitation, diagnostic approaches, and demographic characteristics. Studies from Africa have reported particularly high prevalence,

including 91% among symptomatic patients undergoing upper gastrointestinal endoscopy in Brazzaville, while other studies have reported considerably lower estimates, such as 24.3% among symptomatic children in Uganda and 29.2% among adults in another Ugandan population (Atipo-Ibara et al., 2023; Aitila et al., 2019; Kakooza, 2021). Similarly, prevalence of 43.4–47.4% was reported among patients with gastritis in Cameroon, with older age, alcohol consumption, poor education, and unclean drinking water identified as relevant factors (Agbor et al., 2018). Evidence from Asia and other regions further indicates that the epidemiology is heterogeneous. For example, Wang et al. (2019) reported a prevalence of 52.25% in China, while Ferdaus et al. (2024) identified a prevalence of 36% among dyspeptic patients in Bangladesh. In contrast, Seisenbekova et al. (2025) reported a prevalence of 27.64% among outpatients in Kazakhstan. These differences should not be interpreted as direct evidence of geographical differences alone because the studies varied substantially in population characteristics, clinical presentation, sampling methods, and diagnostic techniques. In particular, studies using serological antibody testing may detect previous exposure in addition to current infection, whereas stool antigen testing, urea breath testing, and endoscopic methods provide different measures of infection status. Nevertheless, a relatively consistent finding across diverse settings is the contribution of environmental and socioeconomic conditions, particularly overcrowding, inadequate sanitation, unsafe water, poor hygiene, smoking, and lower socioeconomic status, although the strength and statistical significance of these associations vary between populations (Bekele et al., 2020; Tsang et al., 2021; Razuka-Ebela et al., 2020). This inconsistency suggests that *H. pylori* risk is context-dependent and supports the need for population-specific epidemiological assessment rather than assuming that risk patterns identified in one setting apply uniformly to another.

Evidence from Pakistan similarly indicates that *H. pylori* remains an important infection among

patients with gastritis and other gastroduodenal disorders, but reported prevalence and associated factors differ across regions and study populations. Zaman et al. (2025) reported a high prevalence of *H. pylori*-related gastritis in Quetta, with greater infection among females and individuals aged 41–50 years. In Rawalpindi, Aziz et al. (2023) reported *H. pylori* positivity in 64.2% of patients presenting with gastroduodenal complaints, while Waqar et al. (2023) reported a prevalence of 41.2% among patients undergoing upper gastrointestinal endoscopy in Karachi and found a significant relationship between infection and gastritis severity, although gender was not significantly associated with infection. Similarly, Ullah et al. (2023) identified associations between *H. pylori* positivity and tobacco use, crowding, poor hygiene, and other environmental and lifestyle exposures in Peshawar. Collectively, these findings indicate that the infection is present across geographically and socially diverse Pakistani populations; however, the available evidence is predominantly derived from specific urban centres, tertiary-care hospitals, or selected high-risk groups. Furthermore, differences in study design and diagnostic methods make direct comparison of prevalence estimates difficult. The existing literature therefore provides evidence of a persistent national burden but does not adequately characterise the prevalence and associated demographic, lifestyle, socioeconomic, and environmental factors among gastritis patients attending healthcare facilities in rural communities. In particular, evidence specific to rural populations of the Gujrat region remains limited. The present cross-sectional study addresses this gap by assessing *H. pylori* infection among adult patients presenting with symptoms of gastritis and examining its relationship with demographic, socioeconomic, lifestyle, dietary, hygiene, environmental, medical, family-history, and psychological factors. The findings are intended to provide locally relevant epidemiological evidence that can complement existing national data and contribute to the understanding of factors associated with *H. pylori* infection in this population.

3. Materials and Methods

3.1 Study Design and Setting

A cross-sectional observational study was conducted among adult patients presenting with clinical symptoms suggestive of gastritis. The study was carried out over a six-month period following synopsis approval, with participant recruitment and data collection conducted from September to November 2025. Participants were recruited from the pathology departments of Sunaan Hospital and Civil Hospital, Kotla Arab Ali Khan, which provide healthcare services to populations from surrounding rural communities.

3.2 Study Population and Sample

The study included 220 male and female patients aged 18 years or above who presented with symptoms suggestive of gastritis, including epigastric or abdominal pain, nausea, vomiting, dyspepsia, and indigestion, and were referred for diagnostic evaluation. Participants were selected using purposive sampling. Individuals previously diagnosed with or receiving treatment for *H. pylori* infection, those with current or previous malignancy, severe comorbid conditions such as end-stage cancer or severe renal or hepatic disease, pregnant or breastfeeding women, and individuals unable or unwilling to provide informed consent were excluded.

3.3 Data Collection

Data were collected using a structured questionnaire developed following a review of relevant literature and reviewed by public health and clinical experts for content validity. The questionnaire was pre-tested before implementation. Information was obtained regarding socio-demographic characteristics, socioeconomic conditions, health-related behaviours, dietary and lifestyle practices, medical and family history, psychological factors, and environmental conditions.

3.4 Laboratory Assessment of *H. pylori*

H. pylori status was assessed using a commercially available one-step *H. pylori* antibody rapid test in accordance with the manufacturer's instructions

and hospital laboratory protocol. For each participant, 2 mL of venous blood was collected aseptically into an anticoagulant-free vacutainer and allowed to clot at room temperature for approximately 45 minutes. Samples were centrifuged at $2000 \times g$ for 10 minutes, after which the separated serum was transferred to labelled sterile microtubes and stored at 4°C until analysis. Before testing, serum samples and test cassettes were brought to room temperature. Three drops

of serum were added to the sample well, and the results were interpreted after 10 minutes. The appearance of both control (C) and test (T) lines was interpreted as a positive result, whereas the presence of only the control line was considered negative. Tests without a control line were considered invalid and repeated. The antibody assay detects *H. pylori*-specific immunoglobulins according to the specifications of the test kit.

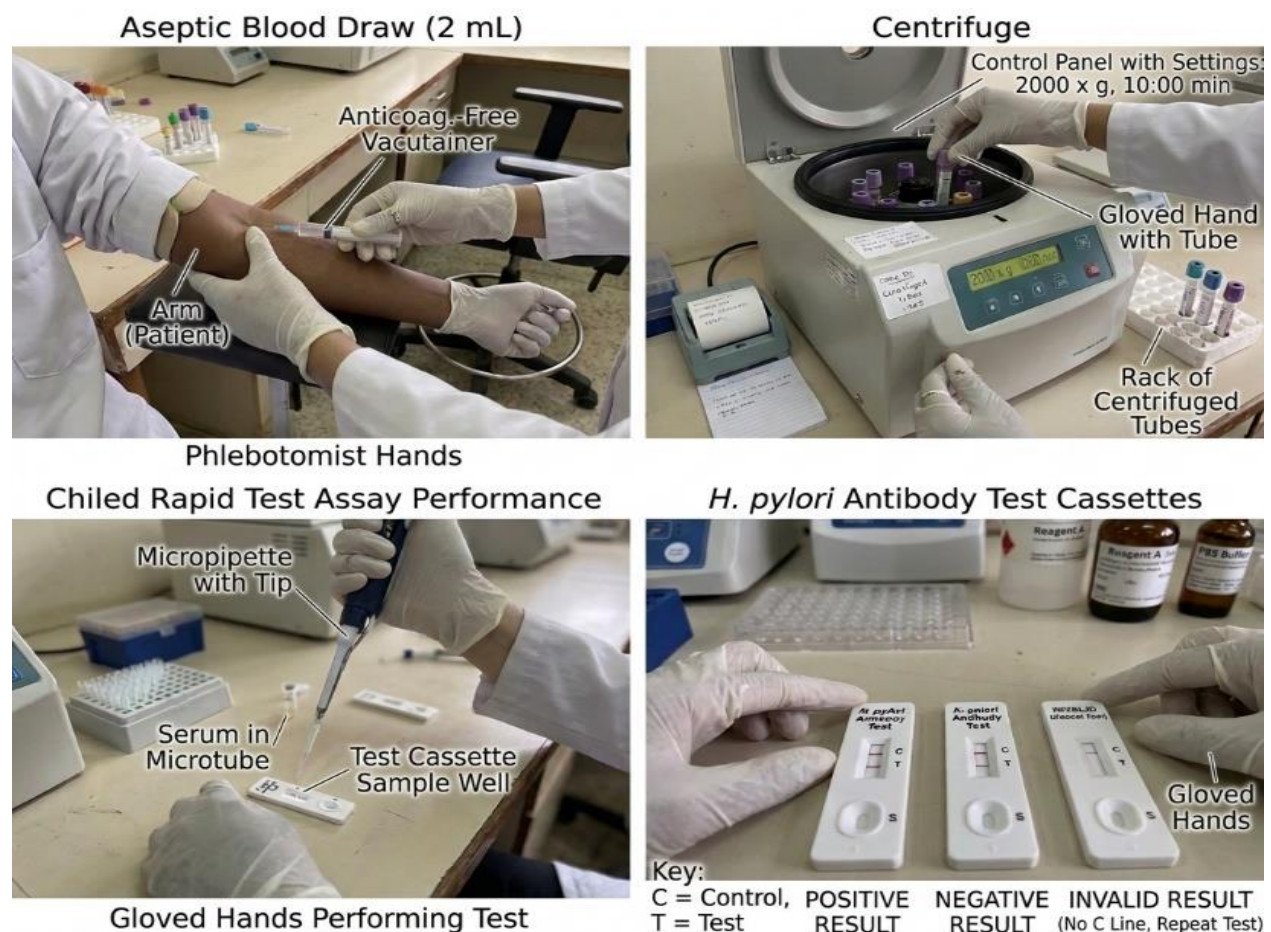


Figure 1: Laboratory assessment workflow for *H. pylori* detection.

(A) Aseptic collection of 2 mL venous blood into an anticoagulant-free vacutainer; (B) Centrifugation of blood samples at $2000 \times g$ for 10 minutes to separate serum; (C) Pipetting 3 drops of separated serum into the sample well of the rapid test cassette; (D) Visual interpretation of test results showing Positive (C and T lines present), Negative (C line only), and Invalid (absence of C line) outcomes.

3.5 Statistical Analysis

Data were coded and analysed using IBM SPSS Statistics version 21.0. Descriptive statistics, including frequencies and percentages, were used to summarise participant characteristics and *H. pylori* positivity. Associations between *H. pylori* test status and categorical demographic, socioeconomic, lifestyle, dietary, hygiene, and environmental factors were assessed using the chi-square test. Odds ratios (ORs) with corresponding 95% confidence intervals (CIs) were calculated to

estimate the strength of associations. A p-value of <0.05 was considered statistically significant.

3.6 Ethical Considerations

Permission to conduct the study was obtained from the participating hospitals. Written informed consent was obtained from all participants before data collection. Participant confidentiality and anonymity were maintained throughout the study, and collected information was used exclusively for research purposes. Participants were informed of their right to withdraw from the study without penalty.

4. RESULTS

Table 1: Baseline Demographic and Socioeconomic Characteristics of Participants (N = 220)

Characteristic	Category	n
Age group (years)	18–49	150
	≥50	70
Sex	Male	111
	Female	109
Education level	No formal education	44
	Primary	55
	Secondary	77
	Tertiary	44
Main source of income	Job/service	15
	Business/shopkeeping	108
	Daily wage labour	35
	Housewife/dependent	54
	Other	8
Residence	Rural	196
	Urban	24
Family history of gastritis/stomach ulcer	Yes	67
	No	106
	Don't know	47

Note. N = total sample size; n = frequency

Table 1 summarises the baseline demographic and socioeconomic characteristics of the 220 participants. Most participants were aged 18–49 years (68.18%), and males and females were represented relatively evenly. Secondary education was the most frequently reported educational level

(35.0%). Business/shopkeeping constituted the most common source of income (49.1%), while 89.09% of participants reported rural residence. Regarding family history, 30.45% reported a history of gastritis or stomach ulcer, whereas 21.36% were unaware of their family history.

Table 2: Prevalence of *Helicobacter pylori* Antibody Positivity Among Participants (N = 220)

<i>H. pylori</i> Antibody Status	n	%
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Positive	138	62.73
Negative	82	37.27

Note. Percentages are based on the total study sample (N = 220). *H. pylori* = *Helicobacter pylori*.

As presented in Table 2, 138 participants (62.73%) tested positive for *H. pylori* antibodies, whereas 82 participants (37.27%) tested negative. Thus, antibody positivity was observed in nearly two-thirds of the study population, indicating a substantial burden of *H. pylori* exposure among patients presenting with gastritis-related symptoms

in the study setting. These findings describe the distribution of antibody positivity within the sampled population; because the study used a cross-sectional design and an antibody-based test, the results should not by themselves be interpreted as confirmation of active infection or a causal relationship with gastritis.

Table 3: *Environmental, Household, and Lifestyle Characteristics of Participants (N = 220)*

Characteristic	Category	n
Main source of drinking water	Tap water	137
	Filtered water	23
	Bottled water	38
	Other	22
Duration of gastritis symptoms	1–3 months	72
	3–6 months	67
	6 months–1 year	50
	More than 1 year	31
Household size	1–3 people	32
	3–5 people	31
	More than 5 people	157
Toileting system	Flush toilet (sewer/drainage)	23
	Flush toilet (septic tank)	90
	Pit latrine	92
	Other	15
Smoking status	Regular smoker	43
	Occasional smoker	27
	Non-smoker	150

Note. n = frequency. Smoking status categories represent the complete study sample (N = 220).

As shown in Table 3, tap water was the most commonly reported source of drinking water, with 137 participants using it. Regarding the duration of gastritis-related symptoms, the largest group reported symptoms for 1–3 months (n = 72), followed by 3–6 months (n = 67). Most participants lived in households containing more than five people (n = 157). For sanitation facilities, pit latrines (n = 92) and flush toilets connected to septic tanks (n = 90) were the most frequently reported systems. Regarding smoking status, 43 participants were regular smokers, 27 were occasional smokers, and 150 were non-smokers. These findings provide descriptive information about the household, environmental, and behavioural characteristics of the study population that can subsequently be examined in relation to *H. pylori* antibody positivity.

Table 4: *Dietary, Medication, Hygiene, and Environmental Characteristics of Participants (N = 220)*

Characteristic	Category	<i>n</i>
NSAID use	Regularly	44
	Occasionally	57
	Rarely	71
	Never	48
Daily stress level	Low	33
	Moderate	92
	High	69
	Very high	26
Spicy/oily food consumption	Daily	107
	A few times per week	74
	Rarely	30
	Never	9
Skipping meals	Yes	70
	No	150
Street/unhygienic food consumption	Frequently	140
	Sometimes	38
	Rarely	17
	Never	25
Treatment of drinking water at home	Always	44
	Sometimes	95
	Never	81
Hand washing before meals	Always	37
	Sometimes/irregularly	53
	Never	130
Perceived local environmental sanitation	Excellent	11
	Good	49
	Fair	17
	Poor	143

Note. NSAID = nonsteroidal anti-inflammatory drug; *n* = frequency.

Table 4 demonstrates the distribution of selected dietary, medication-related, hygiene, and environmental characteristics among the 220 participants. Occasional and rare NSAID use were commonly reported, while moderate stress was the most frequently reported stress category (*n* = 92). Daily consumption of spicy or oily foods was reported by 107 participants, and 140 participants reported frequent consumption of street or unhygienic food. Seventy participants reported skipping meals. Regarding household water treatment, 81 participants reported that they never

treated their drinking water at home. Hand hygiene was also variable, with 130 participants reporting that they never washed their hands before meals. In addition, poor local environmental sanitation was reported by 143 participants. These descriptive findings indicate that several lifestyle, dietary, water-related, and hygiene characteristics were present within the study population and can be further evaluated for their statistical association with *H. pylori* antibody positivity.

Table 5: Association Between *Helicobacter pylori* Test Result and Selected Environmental, Hygiene, and Household Factors (N = 220)

Factor	Category	Positive, n (%)	Negative, n (%)	χ^2	p
Main source of drinking water	Tap water	122 (88.4)	15 (18.3)	107.708	.032
	Filtered water	5 (3.6)	18 (22.0)		
	Bottled water	7 (5.1)	31 (37.8)		
	Other	4 (2.9)	18 (22.0)		
Consumption of street/unhygienic food	Frequently	116 (84.1)	24 (29.3)	71.067	.019
	Sometimes	6 (4.3)	32 (39.0)		
	Rarely	6 (4.3)	11 (13.4)		
	Never	10 (7.2)	15 (18.3)		
Handwashing before eating	Always	8 (5.8)	29 (35.4)	125.395	.048
	Rarely	9 (6.5)	44 (53.7)		
	Never	121 (87.7)	9 (11.0)		
Perceived quality of local environment	Excellent	5 (3.6)	6 (7.3)	105.581	.032
	Good	4 (2.9)	13 (15.9)		
	Fair	5 (3.6)	44 (53.7)		
	Poor	124 (89.9)	19 (23.2)		
Household size	1-3 people	10 (7.2)	22 (26.8)	36.249	.047
	3-5 people	10 (7.2)	21 (25.6)		
	>5 people	118 (85.5)	39 (47.6)		

Note. Values are presented as n (%). Percentages within each factor are calculated separately for *H. pylori*-positive and *H. pylori*-negative participants. χ^2 = Pearson chi-square statistic. $p < .05$ was considered statistically significant.

Table 5 presents the associations between *H. pylori* test results and selected environmental, hygiene, and household factors. Statistically significant associations were observed for drinking water source ($\chi^2 = 107.708$, $p = .032$), consumption of street/unhygienic food ($\chi^2 = 71.067$, $p = .019$), handwashing before eating ($\chi^2 = 125.395$, $p = .048$), perceived quality of the local environment ($\chi^2 = 105.581$, $p = .032$), and household size ($\chi^2 = 36.249$, $p = .047$).

Among *H. pylori*-positive participants, the largest proportions reported tap water use (88.4%), frequent consumption of street or unhygienic food (84.1%), never washing their hands before eating (87.7%), and living in environments perceived as poor (89.9%). Similarly, 85.5% of *H. pylori*-positive participants belonged to households

with more than five members. In comparison, *H. pylori*-negative participants showed greater representation across alternative water sources, less frequent consumption of unhygienic food, more frequent handwashing, better perceived environmental conditions, and smaller household sizes.

5. DISCUSSION

The present study found an overall *Helicobacter pylori* antibody positivity of 62.7% (138/220) among patients presenting with gastritis-related symptoms. This finding indicates a substantial burden of *H. pylori* exposure in the study population and is broadly comparable with the 64.2% prevalence reported in Rawalpindi by Aziz et al. (2023). However, the prevalence was lower

than the very high rates reported from Quetta by Zaman et al. (2025) and Congo by Atipo-Ibara et al. (2023), while higher than the prevalence reported in several African populations, including those studied by Agbor et al. (2018), Abongwa et al. (2017), Aitila et al. (2019), and Bekele et al. (2020). Differences in prevalence may reflect variations in study populations, diagnostic methods, healthcare-seeking behaviour, socioeconomic conditions, and sanitation infrastructure.

In the present study, drinking-water source was significantly associated with *H. pylori* positivity ($\chi^2 = 107.708$, $p = .032$). Among positive participants, 88.4% reported using tap water, compared with greater representation of filtered, bottled, and other water sources among negative participants. This pattern is consistent with findings reported from Congo (Atipo-Ibara et al., 2023), Cameroon (Agbor et al., 2018), Uganda (Aitila et al., 2019), Ethiopia (Bekele et al., 2020), and Bangladesh (Ferdaus et al., 2024), where inadequate or potentially contaminated water supplies have been discussed in relation to *H. pylori* transmission. A possible explanation is that inadequately treated water may become contaminated through poor source protection, defective distribution systems, unsafe storage, or intermittent water supply. Such conditions may facilitate faecal-oral exposure and contribute to household transmission.

Similarly, consumption of street or unhygienic food was significantly associated with infection ($\chi^2 = 71.067$, $p = .019$). A large proportion of positive participants (84.1%) reported frequent consumption of such food. Comparable observations have been reported by Tongtawee et al. (2016) and Hugo et al. (2025), supporting the relevance of food hygiene in populations with frequent exposure to informal food sources. Poor hand hygiene among food handlers, contaminated utensils or water, inadequate food protection, and exposure to dust and other environmental contaminants may provide opportunities for faecal-oral transmission. However, the cross-sectional nature of the present study does not establish that street-food consumption directly caused infection.

Handwashing before eating was also significantly associated with *H. pylori* positivity ($\chi^2 = 125.395$, $p = .048$). Most positive participants (87.7%) reported never washing their hands before meals, whereas negative participants more frequently reported regular handwashing. Similar hygiene-related patterns have been reported in Uganda (Aitila et al., 2019), China (Wang et al., 2019), Cameroon (Abongwa et al., 2017), and Saudi Arabia (Ibrahim, 2024). Inadequate hand hygiene may facilitate transmission through contaminated hands and subsequent hand-to-mouth contact. Limited access to clean water and soap, inadequate hygiene awareness, and household environmental conditions may further reinforce this pathway.

The study also demonstrated a significant association between perceived local environmental quality and *H. pylori* positivity ($\chi^2 = 105.581$, $p = .032$). Among positive participants, 89.9% lived in environments rated as poor, compared with a greater distribution across better environmental categories among negative participants. This finding is consistent with observations from Wang et al. (2019) and studies from African and South Asian settings, where poor sanitation, waste disposal, drainage, and environmental hygiene have been linked with increased exposure to enteric pathogens. In communities with inadequate sanitation infrastructure, repeated exposure to contaminated water, surfaces, food, and waste may increase opportunities for faecal-oral transmission.

Household size was likewise significantly associated with infection ($\chi^2 = 36.249$, $p = .047$). Most *H. pylori*-positive participants (85.5%) belonged to households containing more than five members. This pattern agrees with findings reported from Uganda, Ethiopia, Cameroon, and Pakistan, including Aitila et al. (2019), Bekele et al. (2020), Abongwa et al. (2017), Hamza et al. (2023), and Ullah et al. (2023). Larger households may involve closer interpersonal contact, shared facilities, and greater pressure on water and sanitation resources, potentially facilitating household transmission. Thus, household crowding may act as a marker of cumulative

environmental and interpersonal exposure rather than representing an independent causal factor.

The present study also showed a relatively high proportion of participants reporting smoking, spicy/oily food consumption, meal skipping, stress, and NSAID use. These factors are clinically relevant because smoking and NSAIDs can adversely affect gastric mucosal protection, while dietary practices and psychological stress may influence gastrointestinal symptoms. However, the present analysis primarily demonstrated significant associations for the environmental, hygiene, and household variables reported above; therefore, these behavioural characteristics should not be interpreted as independently established causes of *H. pylori* infection without corresponding inferential analysis.

Regarding demographic characteristics, the study population was almost equally distributed by sex, with 50.5% males and 49.5% females. The absence of a marked sex difference is consistent with Waqar et al. (2024) but differs from the higher female prevalence reported by Zaman et al. (2025) in Quetta and the higher male prevalence reported in some European populations, such as Froelich et al. (2014). Such differences may reflect variation in population structure, occupational and household exposures, healthcare-seeking patterns, and local behavioural practices. The predominance of participants aged 18–49 years in the present study also differs from findings such as those of Zaman et al. (2025), where higher prevalence was reported among older adults. Differences in sampling strategy, study setting, diagnostic procedures, and population characteristics may account for these discrepancies.

The present study identified frequent meal skipping and irregular dietary practices among participants, indicating that dietary behaviour may be an important contextual factor in this population. Regularity and timing of food intake have increasingly gained attention in nutritional research, with chrononutrition emphasising the interaction between meal timing, circadian rhythmicity, and physiological regulation (Shahzadi et al., 2025). Irregular eating patterns

may also be associated with differences in overall dietary quality and meal composition, particularly when individuals routinely delay or omit meals. Breakfast consumption has similarly been discussed as an important component of daily dietary behaviour, although its health implications may vary according to the overall dietary pattern and individual circumstances (Afzal, 2025).

In the context of the present study, these findings are relevant because a substantial proportion of participants reported meal skipping alongside frequent consumption of spicy or oily foods. Such patterns may contribute to gastrointestinal discomfort or symptom persistence through alterations in meal regularity and dietary composition, although the present cross-sectional design does not establish a causal relationship with *H. pylori* infection. Broader research on altered eating patterns, including intermittent fasting, further emphasises the need to consider the potential physiological and behavioural consequences of changes in meal frequency and timing (Noreen et al., 2026). Therefore, dietary regularity should be considered alongside established environmental and hygiene-related factors when interpreting the gastrointestinal health profile of this population.

6 CONCLUSION

The current study examined the prevalence and the risk factors of gastritis caused by *Helicobacter pylori* infection in the rural population of Gujrat and discovered that it is a widespread disease with its prevalence of 62.7. This prevalence rate of infection would signify that *H. pylori* is still a major-public-health issue in the rural setup where the conditions of the environment, conservation techniques and lifestyle issues still favour spread. The results show that the high-risk factors of infection in this environment include unsafe drinking water, poor environmental hygiene, unhygienic street food consumption, poor hand hygiene, overcrowding of households, and smoking. These risk factors are structural issues of lack of accessibility of clean water, poor waste-management facilities, communal abode, low level of hygiene awareness and high dependence on

informal food sources. The main finding is that *H. pylori* is highly prevalent in rural Gujrat, and that preventable environmental and behavioural exposures drive the burden, and that the reduction of infections demands an increase in services and activities in the public-health infrastructure, hygiene and the education of society.

7 LIMITATIONS OF THE STUDY

• *Cross-sectional design*

The researchers have only been able to identify associations at one time, hence, no causal relationships could be made between risk factors and *H. pylori* infection.

• *Rural-area sample only*

In a rural environment, the results cannot be attributed to other urban populations in Gujrat, or other distressed areas, because the environmental, socioeconomic, and lifestyle factors in a rural setting are different.

• *Self-reported data*

Data of hygiene behaviors, diet, smoking, and water treatment were based on the self-reporting of the participants, and it could be influenced by recall bias or under-reporting.

• *Absence of clinical diagnostic confirmation.*

Endoscopic and histopathological analysis to measure the severity of gastritis were not part of the study and, thus, it can be concluded only in terms of infection status and associated symptoms.

• *No evaluation of bacterial strain and antibiotic resistance.*

There was no study into the variations in *H. pylori* virulence and resistance patterns that could affect the severity of the disease.

8 FUTURE RESEARCH RECOMMENDATIONS.

• *Carry out longitudinal research.*

Research to monitor people through time would be needed to determine causality, infection persistence, as well as factors affecting reinfection.

• *Include clinical and diagnostic confirmation.*

Endoscopy, biopsy, urea breath tests and stool antigen test should be added in order to determine

the severity of gastritis and provide more accurate confirmation of infection.

• *Reach urban and peri-urban areas.*

The comparison of studies in various socioeconomic contexts would also assist in determining the contextual factors that cause the highest contribution to disparities in infections.

• *Research on strains of *H. pylori* and antibiotic resistance.*

Molecular and microbiological tests would give information about virulence patterns and inform efficient treatment.

• *Test community-based interventions.*

Future literature should look at how such public-health interventions as water purification campaigns, handwashing programs, and food-safety training can be used to help lower infection rates in rural settings.

• *Evaluate socio-cultural factors.*

A qualitative study on beliefs, practices and obstacles to hygiene may be beneficial in enabling the development of culturally sensitive health-education programs.

Author Contributions

Zainab Mukhtar¹: Conceptualisation and design of the study; data collection; data analysis; interpretation of findings; and preparation of the manuscript.

Akhlaaq Wazeer²: Study supervision; methodological guidance; critical review of the manuscript; and interpretation of the findings.

Akif Ali³: Administrative coordination; academic guidance; and critical revision of the manuscript.

Sam Victor⁴: Contributed to the theoretical and conceptual aspects of nutrition, including the identification, assessment, and interpretation of nutrition- and diet-related variables, and provided expert guidance on

the nutritional framework and interpretation of nutrition-related findings.

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